VIII. *A Description of the Madreporaria dredged up during the Expeditions of H.M.S. 'Porcupine' in* 1869 *and* 1870.

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Read May 16th, 1871.

[Plates XXXIX. to XLIX.]

Contents.

I. Introduction.

Zoophytologists have long known that some simple Madreporaria, or Stony Corals, live at a depth of from 80 to 150 fathoms on the floor of the Atlantic and Pacific Oceans, in areas remote from coral reefs. The existence of Madreporaria at corresponding depths in the Mediterranean Sea has also been known practically to those interested in the red-coral fisheries. Nevertheless it was until lately tacitly admitted that all corals obeyed the laws which regulate the bathymetrical distribution of reef-building forms. But it is only during the last four years[1] that a fine and peculiar[2] coral fauna has been proved to exist not only at great depths but also in temperatures ranging from below freezing-point to 55° Fahrenheit. Although Foraminifera and Echinodermata have been brought up from profound depths by the sounding-apparatus, no trace of a stony coral had been observed; and it was not until the United-States Coast Survey dredged between Key West and Havana in 1867, that any proof of the existence of Madreporaria at a great depth was obtained. On May 24th, 1867[3], stony corals were dredged up alive from the depth of 270 fathoms; and on May 25th the same species was obtained from 350 fathoms. In the following year, 1868[4], many species were dredged up under the supervision of M. de Pourtales, as naturalist, off the Florida reef, in the course of the Gulf Stream, from 43 to 324 fathoms.

The expedition of H.M.S. 'Lightning,' in the same year, conducted under the super-

[1] The researches of Sars, MacAndrew, Norman, and J. Gwyn Jeffreys prepared the way for those of the United States Expeditions and of H.M.SS. 'Lightning' and 'Porcupine,' under Pourtales and A. Agassiz, and Wyville Thomson, Carpenter, and Gwyn Jeffreys respectively.

[2] "Coral Faunas of Western Europe," Quart. Journ. Geol. Soc. 1870, P. M. Duncan.

[3] "Contributions to the Fauna of the Gulf Stream at great Depths," by L. F. de Pourtales, No. 6 Bulletin of the Harvard Museum of Comparative Zoology, 1st series.

[4] *Op. cit.* 2nd series.

vision of Professor Wyville Thomson, Dr. Carpenter, and Mr. J. Gwyn Jeffreys, in the North Atlantic, afforded satisfactory evidence of the existence of a coral fauna in the deep sea, and in water of a very different temperature from that usually considered necessary for the Madreporaria; but it was not until 1869 that, under the same able direction, the systematic dredgings of H.M.S. 'Porcupine' proved the existence of coral life at a depth of 705 fathoms[1].

A description of this dredging expedition was read before the Royal Society in 1870, by Messrs. Carpenter, Wyville Thomson, and J. Gwyn Jeffreys[2], and a report on the corals[3] obtained by those naturalists, and intrusted to me for examination and description, was read before the same Society March 24th, 1870.

When the second expedition was preparing to start in 1870, under the same able guidance, particular requests were made to me to advise concerning the dredgings, so far as the corals were concerned. The employment of the "hempen tangles," instead of the crushing dredge, had already commended itself to the superintendents of the dredging operations; and it was a satisfaction to find that by using these simple means a fine collection of specimens was obtained off the west and south-west coast of the Spanish Peninsula and along the Mediterranean coast of Africa, from depths which reached to 1095 fathoms.

All the information I have required has been freely given me by the three naturalists who were responsible for the dredgings, and also by M. Lindahl their assistant.

Professor A. Agassiz and Count Pourtales were of great assistance to me by sending me their reports and also a collection of the specimens dredged up by them, so that I have been enabled to compare the North-Atlantic forms with the West-Indian and Floridan types.

I have also had the advantage of examining the results of the dredgings conducted by Mr. Kent, of the British Museum, and of his assistance in comparing specimens.

The majority of the specimens dredged up and entangled during the two expeditions of the 'Porcupine' were alive and in good condition; a few had been dead for some time and were covered with Sponges, Serpulæ, and Polyzoa. Specimens were not invariably obtained at every dredging; and it is evident that corals live here and there in patches, and that they mostly frequent rocky ground, although some species live in the Globigerine ooze. Fine muddy sediment appears to be unfavourable to coral life; and many of the dead specimens which came up in the dredge were filled with it.

It is somewhat remarkable that so many well-known species, especially of the Medi-

[1] Proc. Royal Society, 1870.

[2] W. B. Carpenter, F.R.S., Wyville Thomson, F.R.S., and J. Gwyn Jeffreys, F.R.S., "Deep-Sea Researches," Proc. Roy. Soc. 1870, vol. xviii. pp. 397–492.

W. B. Carpenter, F.R.S., and J. Gwyn Jeffreys, F.R.S., "Deep-Sea Researches," Proc. Roy. Soc. 1870, vol. xix. pp. 146–221.

[3] P. M. Duncan, 'Porcupine'-Expedition Madreporaria, Proc. Roy. Soc. 1870, vol. xviii. pp. 289–301.

terranean coral fauna, should not have been obtained by the dredge and tangles. Some of them are dwellers in moderately deep water, and have been noticed by Forbes and Milne-Edwards and Jules Haime. On the other hand it is satisfactory to have obtained so many specimens of certain rare corals that the doubts about their classificatory position could be solved by subjecting a few to transverse and longitudinal section.

The results of this procedure, with respect to *Lophohelia prolifera*, Pallas, sp., and *Amphihelia oculata*, Linnæus, are very damaging to the integrity of the family of the Oculinidæ; for, as the corallites of these species do not fill up from within, they can no longer be separated from the Astræidæ. Moreover longitudinal sections of the corallum of specimens of the first-named species show dissepiments and large tabulæ; and thus the propriety of establishing a section of the Madreporaria which shall be differentiated by these perfect transverse floors of endotheca is strongly contra-indicated.

The specimens obtained in both of the expeditions of the 'Porcupine' can be arranged into forty-eight groups, consisting of species and varieties—*i. e.* twenty-seven species and twenty-one varieties. There are, amongst these, fourteen new species, twelve species already described, and one *incertæ sedis*. The varieties consist of four the typical forms of which are not present in the collection, and of seventeen which accompany the specific types also.

Owing to the extraordinary variability of some of the corals, I have been able, by comparing them with the descriptions and types of closely allied recognized species, to absorb several specific forms, and in two instances to treat genera so. Thus I have absorbed the genus *Ceratocyathus* in the older genus *Caryophyllia*, and *Thecopsammia* in *Balanophyllia*.

The species *Caryophyllia borealis*, Fleming, and *C. smithi*, Stokes, I have made varieties of the older type *Caryophyllia clavus*, Scacchi. The *Sphenotrochus intermedius*, Ed. & H., of the Crag and Tangier Bay, and *Sphenotrochus milletianus*, Defrance, are varieties of the same type. Two species of *Desmophyllum* are absorbed into the species *cristagalli*; and its range, therefore, is enlarged. No less than seven species and two genera must now be aggregated in the *Amphihelia ramea* of Müller; and three if not four species of *Lophoheliæ* should be associated with the species *prolifera* and its variety *gracilis*.

At least fourteen old species have been thus absorbed, and, it is trusted, not to the detriment of truth or of a true classificatory philosophy.

The following is the list of the Madreporaria dredged up in the two expeditions of the 'Porcupine':—

II. Classification of the Species.

ZOANTHARIA SCLERODERMATA[1].

Section APOROSA.

Group **Turbinoliidæ.**

Subfamily Caryophylliinæ.

Genus Caryophyllia.

Species 1. *Caryophyllia clavus*, Scacchi, sp.
—— ——, variety *α. elongata.*
—— ——, variety *β. exserta.*
—— ——, variety *γ. borealis.*
—— ——, variety *δ. smithii.*
—— ——, variety *ε. epithecata.*
Species 2. —— *cyathus*, Ellis and Solander. A variety.
3. —— *arcuata*, Ed. & H. A variety.
4. —— *cylindracea*, Reuss. Two varieties.
5. —— *abyssorum*, Duncan.
6. —— *inskipi*, Duncan.
7. —— *calveri*, Duncan.
8. —— *vermiformis*, Duncan.
9. —— *pourtalesi*, Duncan.
10. —— *seguenzæ*, Duncan.

Syn. *Ceratocyathus ornatus*, Seguenza.

Genus Bathycyathus.

Species 1. *Bathycyathus atlanticus*, Duncan.

Subfamily Trochocyathaceæ.

Genus Paracyathus.

Species 1. *Paracyathus agassizi*, Duncan.
2. —— *striatus*, Philippi, sp.

Division Turbinoliaceæ.

Genus Sphenotrochus.

Species 1. *Sphenotrochus intermedius*, Münster, sp.

Genus Sabinotrochus, gen. nov.

Species 1. *Sabinotrochus apertus*, Duncan.

[1] Hist. Nat. des Corall., MM. Milne-Edwards and Jules Haime. 1860, Paris.

Genus DESMOPHYLLUM.

Species *Dèrmophyllum crista-galli*, Ed. &. H.

Varieties (old species): *α. cumingi*, *β. costatum.*

Genus FLABELLUM.

Species 1. *Flabellum distinctum*, Ed. & H.

SYN. *Flabellum extensum*, Mich.

Species 2. *Flabellum laciniatum*, Ed. & H.

SYN. *Ulocyathus arcticus*, Sars.

Genus RHIZOTROCHUS.

Species 1. *Rhizotrochus affinis*, Duncan.

Division GEMMANTES.

Genus AMPHIHELIA.

Species 1. *Amphihelia oculata*, Linnæus, sp.

2. —— *ramea*, Müller.

SYN. *Amphihelia miocænica*, Seguenza.

—— *sculpta*, Seguenza.

—— *atlantica*, nobis.

—— *ornata*, nobis.

Diplohelia profunda, Pourtales.

—— *meneghiniana*, Seguenza.

—— *doderleiniana*, Seguenza.

—— *gismondiana*, Seguenza.

Family **Astræidæ.**

Division EUPHYLLIACEÆ.

Section EUPHYLLIACEÆ CÆSPITOSÆ.

Genus SOLENOSMILIA, gen. nov.

Species 1. *Solenosmilia variabilis*, Duncan.

Division STYLINACEÆ.

Section STYLINACEÆ INDEPENDENTES.

Genus LOPHOHELIA.

Species 1. *Lophohelia prolifera*, Pallas, sp.

SYN. *Lophohelia anthophyllites*, Ellis & Solander.

—— *subcostata*, Ed. & H.

Syn. *Lophohelia defrancei*, Defrance, sp.
—— *stoppaniana*, Seguenza.
—— *affinis*, Pourtales.

Variety *gracilis*.

Syn. *Lophohelia gracilis*, Seguenza.

Family **Oculinidæ**.

Subfamily Stylasteraceæ.

Genus Stylaster.

Species 1. *Stylaster gemmascens*, Esper, sp.

Section PERFORATA.

Family **Madreporidæ**.

Subfamily Eupsammiinæ.

Genus Balanophyllia.

Species 1. *Balanophyllia gaditana*, Duncan.
2. —— *cellulosa*, Duncan.
3. —— *socialis*, Pourtales, sp.

Syn. *Thecopsammia socialis*, Pourtales.

Varieties α and β.

Genus Dendrophyllia.

Species *Dendrophyllia cornigera*, Lamarck, sp.

Family **Fungiidæ**.

Genus Fungia.

Species *Fungia symmetrica*, Pourt.

Section RUGOSA.

Family **Cyathaxonidæ**.

Genus Guynia, gen. nov.

Species *Guynia annulata*, Duncan.

Genus incertæ sedis.

Species 1.

III. Descriptions of the Species, and Remarks.

ZOANTHARIA SCLERODERMATA.

Section APOROSA.

Group **Turbinoliidæ.**

Genus Caryophyllia, M.-Edwards & Haime.

Syn. *Caryophyllia* (pars), Lamarck.
Cyathina, Ehrenberg.

This genus comprehends numerous species, many of which are peculiar to the recent coral faunas; but some belong both to the present and to the past assemblages of corals. The species are usually very variable; and the depth of habitat and the peculiar nature of the sea-floor appear to influence the amount and persistence of the variation. MM. Milne-Edwards and Jules Haime divide the genus into groups of species which are characterized by the persistence of particular septal numbers; and this method, if not a very natural one, is excessively convenient to the student. When a considerable series of closely allied species is examined, great variation will be noticed in the shape and size of the base of attachment in different specimens. Some, which evidently belong to the same species, and which have all the other structures in common, may have a broad and adherent base, or a narrow and pedunculate attachment; and a few may have a sharp and pointed or even a rounded end, indicating a former state of adhesion to a foreign body.

Thus the specific identity of the forms formerly called *Caryophyllia borealis*, Fleming, and *Caryophyllia smithii*, Stokes, is beyond doubt: yet the first-named has a narrow and curved peduncle attached to the Ditrupa-case and to shells; and the last has a broad base, which is adherent to rocks and shells.

When *Caryophyllia borealis* locates itself on stones or flat shells, it frequently assumes the form of *Caryophyllia smithii*, and grows with a broad base. And when a deposit collects around the normal *Caryophyllia borealis* its peduncle may diminish in size and become separated. This is a common occurrence in the neighbourhood of Valentia and Dingle Bay.

I trust that this statement will facilitate the absorption of the genus *Ceratocyathus*[1], Seguenza, into *Caryophyllia*, as they are only distinguished by the character of the peduncle.

It is therefore proposed to include the *Ceratocyathi* amongst the *Caryophylliæ* described in this communication; and the last-named genus will be subdivided according to the plan adopted by MM. Milne-Edwards and Jules Haime[2].

[1] "Disquisiz. Paleont.," Mem. della Reale Acad. dell Sci. Torino, serie ii. tom. xxi. 1864.

[2] Hist. Nat. des Corall. vol. ii. p. 13 *et seq.*

Species with four perfect Cycles of Septa, and some orders of the fifth Cycle.

1. *Caryophyllia cyathus*, Ellis & Solander, sp.
2. —— *clavus*, Scacchi.
3. *Caryophyllia seguenzæ*, Duncan. (Syn. *Ceratocyathus ornatus*, Seguenza.)

Species with four perfect Cycles of Septa.

1. *Caryophyllia arcuata*, Ed. & H.

Species with the fourth Cycle of Septa incomplete.

1. *Caryophyllia cylindracea*, Reuss.
2. —— *abyssorum*, Duncan.
3. —— *inskipi*, Duncan.
4. *Caryophyllia calveri*, Duncan.
5. —— *pourtalesi*, Duncan.

Species with three Cycles of Septa[1].

1. *Caryophyllia vermiformis*, Duncan.

The range of the species:—

Caryophyllia clavus and its varieties were found in nearly every dredging in the Mediterranean. The type and the varieties were dredged up at the depth of 364 fathoms, south of Cape St. Vincent, and of 705 fathoms in the North Atlantic (88 station). The sea-bottom off Unst, off the coast of Norway, and off the north-eastern coasts of Scotland, at a depth of 90 fathoms, is its commonest habitat. The species (a variety) is also common in shallower water off the west coast of Ireland, and as a littoral form on the south-west coasts of England.

The species is represented by fossil forms in the older Pliocene of Sicily.

Caryophyllia cyathus, Scacchi, is a well-known Mediterranean species; but the true typical form was not dredged up, although the red-coral fisheries abound with it. A variety with slender septa and a small base was found at 651 fathoms, due west of the Straits of Gibraltar.

Caryophyllia seguenzæ, Duncan (syn. *Ceratocyathus ornatus*, Seguenza), was dredged up in the North Atlantic (station 88) from the depth of 705 fathoms; and it is known as a fossil form at Rometta, in the Zanclean formation or older Sicilian Pliocene.

Caryophyllia arcuata, Ed. & H., has hitherto only been known as a fossil form. A variety was dredged up (stations 19 & 20, 2nd expedition) in 248 and 304 fathoms, off the south-western coast of the peninsula.

The fossil forms are from the older Pliocene rocks in Sicily.

Caryophyllia cylindracea, Reuss. A careful examination of some specimens dredged up (9 & 17 *a* stations, 2nd expedition) from a depth of 539 and 740 fathoms leads to

[1] This is a new division; for *Caryophylliæ* with three cycles of septa have been hitherto unknown.

the belief that they are slight varieties of this well-known Cretaceous type. The species is common in the upper and middle white chalk of North-western Europe.

Caryophyllia abyssorum, Duncan, was dredged up from a depth of 1095 fathoms (No. 17 station, 2nd expedition). It is closely allied to the Cretaceous type *Caryophyllia cylindracea*, Reuss; but it has not been found elsewhere.

Caryophyllia inskipi, Duncan, was dredged up from 539 fathoms (No. 9 station, 2nd expedition). It has affinities with the Cretaceous species.

Caryophyllia calveri, Duncan, was dredged up from 292 fathoms (No. 24 station, 2nd expedition).

Caryophyllia vermiformis, Duncan, and *Caryophyllia pourtalesi*, Duncan, belong to a new type, and they are the first species of the genus which have been discovered to have only three cycles. Their range is restricted to the sea to the west and south-west of the Spanish peninsula, and they live at the depth of from 227 to 740 fathoms.

CARYOPHYLLIA CLAVUS, Scacchi. (Plate XLVIII. figs. 9, 10.)

The corallum is conical, and is fixed by a narrow peduncle to all sorts of foreign bodies.

The costæ are distinct from the base, are usually straight, and are most projecting near the calice. They are thin, slightly wavy here and there, granular, and unequal.

The epitheca occurs in some parts of the outside of the corallum in the form of detached bands.

The calice is elliptical, and the fossa is large. The columella is small, and is formed of from four to nine twisted processes.

The septa are thin and granular; the largest are slightly exsert and equal. There are four complete cycles of them, and part of the fifth cycle also. The higher orders of septa are small.

The pali are thin, long, projecting, and are marked with a concave cup-shaped ornamentation, or with granules.

The typical form was found in No. 28 dredging, 2nd expedition of the 'Porcupine,' in 304 fathoms, and also in dredgings Nos. 26, 29, and 57.

There is perhaps no more variable form of simple coral than *Caryophyllia clavus*, Scacchi, sp. It has a considerable horizontal range, being found throughout the Mediterranean at many depths, and in the Norwegian seas, and also in the western seas off Ireland. The species is, moreover, found in the Old Pliocene of Sicily.

Variety *α. elongata.* (Plate XLVIII. figs. 7, 8.)

The corallum is tall, cylindro-conical, or almost cylindrical, compressed, often curved and twisted, and marked with epithecal rings and accretion-ridges.

The costæ are sharp, wavy, and rarely granular. The base is small.

These forms were obtained in the 2nd expedition of the 'Porcupine,' in dredgings No. 57, and off the Mediterranean coast of Africa.

Variety β. *exserta*. (Plate XLVIII. fig. 5.)

The corallum is short, finely pedicillate, and then bulky and turbinate.

The primary and secondary septa are very exsert.

The costal ornamentation is like that of the type.

The epitheca is scanty.

From dredgings in Cartagena Bay.

Variety γ. *borealis*. (Plate XLVIII. fig. 6.)

This is the form described by Fleming, and is very common in the North Atlantic and off the north-east coast of Scotland.

The corallum is more compressed than the type.

The columella is larger.

The costæ are broader and more distinct, and often very granular or sharply aciculate.

The epitheca, or a granular state of the wall, reaches some distance from the base, which is small and attached.

This variety was found in the dredgings of the first expedition of the 'Porcupine,' No. 88 and No. 2; in the dredgings of the second expedition in No. 29. The specimens attach themselves to a *Ditrupa*, shells, and Echinoderm-spines.

Variety δ. *smithii*. (Plate XLVIII. figs. 11, 12.)

This is the *Caryophyllia smithi*, Stokes, which is so common on the shores of the extreme south-west of England. It has a broad base; but this is the only strong distinction between it and *Caryophyllia clavus*. The gradation of a delicate pedunculated *Caryophyllia clavus* into a broad-based form with all the other specific peculiarities, depends upon the depth of the water and the nature of the bottom; and the variety *borealis* gradually becomes variety *smithii*, both in the northern seas and in the Mediterranean.

The costæ are usually very distinct, and some are prominent, and are either granular or covered with sharp points. The columella varies in extent.

The specimens were derived from dredgings off the Mediterranean coast of Africa, and from the telegraph-cable at Malta, and from No. 88 and No. 2 dredgings in the first expedition of the 'Porcupine.'

Variety ε. *epithecata*. (Plate XLVIII. figs. 13–16.)

This variety is very well marked in the numerous specimens which were dredged in

shallow water in Dingle Bay, and in from 90 to 110 fathoms in No. 6 dredging of the first expedition of the 'Porcupine.' The variety is also found off Valentia.

The corallum is attached by a small peduncle during the early part of its existence; and it usually, but not invariably, separates by friction subsequently; and then the peduncle diminishes in size.

The characteristic peculiarities are the curved compressed conical shape, the large growth, and the exsert septa, and the epitheca, which reaches close up to the calicular margin. The costæ are largely granular, and the fossa is deep.

Caryophyllia cyathus, Ellis & Solander, sp.[1]

Variety *α*. *africana*. (Plate XLVIII. figs. 3, 4.)

The corallum is compressed, curved, and attached by a delicate peduncle.

The septa are not so close or so short as in the typical form.

The epitheca is not so complete.

The specimen was dredged up in the second expedition of the 'Porcupine' (No. 32), in 651 fathoms.

Caryophyllia arcuata, Ed. & H.

Variety *α*, with prominent costæ. (Plate XLIII. figs. 1–4.)

The corallum is tall, with a large incrusting base, a long cylindrical stem, and a conico-cylindrical termination.

The calice is subcircular, and the margin is irregular from the larger septa being on a higher level than the others.

The septa are stout, unequal, granular laterally, and rounded above. There are *four cycles* of them, in six systems. The primary and secondary septa are equal, are higher than the others, and are continued as prominent semicristiform costæ down two thirds of the outside of the corallum. The septa of the fourth and fifth orders are nearly as high as the larger ones, and higher than those of the third cycle.

The pali are large and rounded, and flat.

The columella is small, and is composed of eight processes.

The fossa is shallow.

The costæ are almost equal; but those of the tertiary and quaternary cycles are not prominent like the others, but are flat; and all are marked by close transverse rows of granules, separated by transverse grooves.

On the round part of the stem the costal ornamentation is simply granular.

Height of corallum $\frac{11}{10}$ inch; height of calice $\frac{7}{20}$ inch.

Dredged up in No. 19, from 248 fathoms, 2nd expedition; No. 28, from 304 fathoms, 2nd expedition.

An examination of the great series of *Caryophylliæ* which has been obtained during

[1] MM. Milne-Edwards and Jules Haime, *op. cit.* vol. ii. p. 13.

the dredgings, and of a number of forms from shallow water, proves that the shape of the peduncle and base of the corallum varies according to external conditions. To separate the forms which have peduncles attached to foreign bodies from those which are pedunculate but free, and with or without a scar, is not possible, according to the results of the above-mentioned examination, except on the plan of a necessary artificial division of a great and closely allied set of forms. *Ceratoeyathus*, a genus founded by Seguenza to admit pedunculate forms, is thus clearly only a subsection of the *Caryophylliæ*; and I propose to absorb it.

There is a very elegant coral which was dredged up from a depth of 705 fathoms, No. 88, first expedition of the 'Porcupine,' and which belongs to the species *Ceratocyathus ornatus*, Seguenza[1].

It appears to belong to the pedunculate *Caryophylliæ* which have a thick granular epitheca. I have therefore named the form *Caryophyllia seguenzæ*; for there is a *Caryophyllia ornata* described by Seguenza.

CARYOPHYLLIA SEGUENZÆ, Dunc. (Plate XLIV. figs. 4–6.)

SYN. *Ceratocyathus ornatus*, Seg.

The corallum is short, conical, compressed, subgibbous, and has a very small, short, and twisted peduncle.

The epitheca is stout and very granular.

The calice is elliptical and open.

The columella is formed of three or more twisted processes, and is well developed.

The pali are long, and are granulated laterally.

The septa are very unequal, the last cycle being rudimentary, and very small. The larger septa are thick at the margin, and exsert. There are six systems of septa; and the fifth cycle is nearly complete.

The costæ are unequal, and they are prominent near the calicular margin.

Height of corallum $\frac{4}{10}$ inch; length of calice $\frac{8}{10}$ inch.

Caryophylliæ with the fourth cycle of septa incomplete.

There are several specimens of species of *Caryophylliæ* which have unequal septal systems owing to the imperfect development of the fourth cycle. This peculiarity is not accidental, or even produced by the forms not having reached their full growth; for it persists in tall, full-grown corals. It characterizes the Cretaceous *Caryophyllia cylindracea*, Reuss, and the existing *Caryophyllia berteriana*, Duchassaing, of Guadeloupe. In consequence of this alliance with a common Cretaceous type, it is requisite to examine the forms with the incomplete fourth cycle very carefully and critically.

The following is the diagnosis of *Caryophyllia cylindracea*, Reuss, a species from the Upper and Middle White Chalk[2].

[1] *Op. cit.* p. 431.

[2] MM. Milne-Edwards and Jules Haime, *op. cit.* vol. ii. p. 19.

The corallum is elongate, subcylindrical, and either straight or slightly curved. The wall is smooth and shining in its lower two thirds; and in the upper third there are small subequal costæ, which project very slightly. The calice is subcircular. The columella is fasciculate, and is formed of a small number of slender "tigelles." There are four cycles of septa; but in three systems one of the halves is deprived of the septa of the fourth and fifth orders. The septa are thin, and only slightly thickened externally. The pali are narrow and thick.

One of the specimens dredged up from No. 17 *a*, 740 fathoms, and off the Portuguese coast, is evidently closely allied to the Cretaceous form. It has all the peculiarities of *Caryophyllia cylindracea*, and differs from it in having the varnished-looking wall (epitheca) continued up to the calicular margin, and in having the septa rather stouter and the pali thicker. These are not specific distinctions in a genus which is most variable; and therefore I have retained the specific name, and have considered the existing form a variety of the Cretaceous type.

Caryophyllia cylindracea, Reuss. (Plate XL. figs. 5–8.)

Variety α. With prolonged epitheca, thicker septa and pali.

Three dead specimens of an allied form were dredged up from the "Channel slope" (No. 9, 539 fathoms); and one is sufficiently well preserved to be drawn. It is a variety of the Cretaceous form; and the epitheca does not reach higher than in the type, but the pali are much thicker.

Variety β. With very thick septa and pali (figs. 9–12).

Caryophyllia abyssorum, Duncan. (Plate XL. figs. 1–4.)

The corallum is elongate and slightly curved. It has a broad base and a long cylindrical pedicel, which gradually enlarges into a turbinate upper part.

The costæ are distinct from the base to the calice, and are larger and broader towards the calicular end. The costæ of all orders are equal and are granular.

The epitheca is finely granular, and is difficult to distinguish from the wall. The septa are thick, close, unequal; and the larger are exsert. They are granular, and are ornamented by radiating ridges. There are four cycles of septa, but the fourth and fifth orders are absent in some half-systems.

The pali are rounded, narrow, tall, and wavy, and have lateral swellings.

The columella is small, deeply situate, and is composed of eight or nine projecting and twisted processes.

The calice is elliptical in outline, and the margin is thick, the fossa being rather deep.

Height of corallum $\frac{14}{10}$ inch; length of calice $\frac{4}{10}$ inch.

Dredged up from 1095 fathoms (No. 17, 2nd expedition), and had not been dead any great length of time.

Caryophyllia inskipi, Duncan.

The corallum is short and curved. It has a small base, which is marked by a fracture of its attachment.

The epitheca is dense, and covers the whole external surface; it is granular, and conforms to the subequal costæ, which extend downwards to the base without any marked diminution in their size. Superiorly the costæ join the stout and barely exsert septa.

The calice is subcircular, shallow externally, and deep over the columella.

The septa are alternately large and small, are largest at the margin, and are granular. There are four cycles in most of the systems, and the higher orders are missing in the half of two systems.

The columella is very small, and situated deeply.

The pali are very tall, and rather thick, but small.

Height of corallum $\frac{4}{10}$ inch; breadth of calice $\frac{2}{10}$ inch.

The specimen from which this description is taken was dead, and came up in dredging No. 9, 539 fathoms, 2nd expedition. I have named it after Commander Inskip, one of the naval officers who contributed so much to the success of the deep-sea dredgings.

Caryophyllia calveri, Duncan.

The corallum is short, subturbinate and cylindrical.

The costæ are subequal, flat and granular from their epithecal covering. The primary and secondary costæ reach highest.

The calice is circular in outline, is shallow; and the primary and secondary septa are very exsert and arched.

The columella is small, and is composed of two or three processes.

The pali are curved, projecting and twisted; they are larger than the tertiary septa, before which they are placed.

The septa are unequal, and are marked by radiating eminences, which depend upon curving of the laminæ.

There are six systems of septa; and there are four cycles in five, and three in the remaining cycle.

Height of corallum $\frac{3}{10}$ inch; breadth of calice $\frac{2}{10}$ inch.

I have named this beautiful coral after Captain Calver, to whom the dredging-expeditions owe so much of their success. Dredged up from 292 fathoms (No. 24).

Caryophyllia vermiformis, Duncan. (Plate XL. figs. 13–16.)

The corallum has a broad expanded base, a cylindrical and curved stem, and a slightly elliptical shallow calice.

The costæ are distinct near the calice, where they are alternately large and small, flat and granular; and they are less distinct towards the base, where the granules are still apparent.

The septa are stout, unequal, and crowded; none are exsert; but they are rather wavy. The primary are not readily distinguishable from the secondary septa; but these are longer than the tertiary. There are six systems of septa, and three cycles in each.

The columella is formed by one twisted process.

The pali are small, and are placed before the secondary septa.

Height of corallum $\frac{6}{10}$ inch; breadth of calice $\frac{3}{20}$ inch.

Dredged up No. 17 *a* dredging, 2nd expedition of the 'Porcupine.'

CARYOPHYLLIA POURTALESI, Duncan. (Plate XLII. figs. 3–10.)

The corallum is subturbinate, curved, and swollen.

The calicular margin is circular; and the base, which is truncated, is marked by the results of displacement from the foreign body to which it was attached by a very small peduncle.

The costæ are flat, broad, equal, and terminate at the calice in angular points, which are much broader than the septa.

The epitheca is shining, and gives the chevron and granulated ornamentation to the costæ.

The calicular fossa is shallow. The columella is very small, and is formed by one or two twisted processes. The pali are irregular and tall.

The septa are unequal, not exsert, are wavy, very granular laterally, and delicate; they are wide apart, and are in six systems. There are three cycles of septa in each system, and some members of the fourth in some systems.

Height of corallum $\frac{6}{10}$ inch; breadth of calice $\frac{5}{20}$ inch.

There are some young specimens, which prove that the septal number is reached very early, and that the epitheca covers the costæ and intercostal spaces at first, and does not permit them to be seen (figs. 4–7).

Dredged up in the second expedition of the 'Porcupine,' in stations 24 and 29.

American *Caryophylliæ*.

M. de Pourtales describes *Caryophyllia cornuformis*, Pourt., which he obtained in 237 and 248 fathoms, off Sand Bay and the Samboes, Florida, on a bottom consisting of Foraminifera. It has four cycles; but the pali are before the secondary septa. This anomaly separates the species from all others. Otherwise it belongs to the *Arcuata* type.

Caryophyllia formosa, Pourt., was found by the same excellent naturalist off Havana, in 270 fathoms. It is closely allied to *Caryophyllia arcuata*, Ed. & H.

Caryophyllia berteriana, Duchassaing, Anim. Rad. des Antilles, a form with four incomplete cycles of septa and large costæ, is found off Guadeloupe, and perhaps in 68 fathoms off the Tortugas (*Pourtales*).

Genus Bathycyathus, Milne-Edwards & Jules Haime, 1848.

Bathycyathus atlanticus, Duncan. (Plate XLVIII. figs. 1, 2.)

The corallum is circular in outline at the base, but becomes compressed above, so that the axes of the calice are very unequal.

The corallum is in the shape of a reversed and compressed cone.

The calice is elliptical in outline, and the great axis is on a lower plane than the smaller.

The septa at the reticular margin are exsert, and project outwards so as to give a very open aspect to the deep calice. The septa are unequal, and the primary and secondary laminæ are very prominent. The septa of the last cycle are larger than the penultimate.

There are four complete cycles of septa, and also three derived septa from the fifth cycle, so that there is an appearance of thirteen sets of three septa and thirteen large septa. The septa are granular, and ornamented with radiating lines of granules.

The pali are large, distinct, prominent, very granular, and are placed before the tertiary cycle.

The columella consists of essential and ribbon-shaped processes, and is well developed and deep in the fossa.

The costæ are broad, granular, and subequal; but those of the largest septa are distinctly prominent far down towards the base.

Height of corallum 1 inch to $1\frac{1}{2}$ inch; length of calice $\frac{8}{10}$ inch; breadth of calice $\frac{7}{10}$ inch.

Some fragmentary specimens evidently belonged to larger forms. The coral was found in No. 17 *a* and No. 17 dredgings, in the second expedition of the 'Porcupine,' and in 740 and 1095 fathoms.

The genus *Bathycyathus* is closely allied to the *Caryophylliæ*; and were it not for the peculiar structure of the upper part of the septal apparatus, it would be included amongst them.

The species hitherto described, viz. *Bathycyathus chilensis*, Ed. & H., *B. indicus*, Ed. & H., and *B. sowerbyi*, Ed. & H., have five complete cycles of septa. The first two are recent forms, and are probably identical, and were dredged up off the coast of Chili, at a depth of 80 fathoms, and off Juan Fernandez.

The fossil species (*Bathycyathus sowerbyi*, Ed. & H.) of the Upper Greensand is never found in a perfect state, and is closely allied to the recent forms.

Hence the new species, with its defective fifth cycle, is less closely allied to the Cretaceous type than its Pacific congeners. The genus has not been found represented in any Upper Cretaceous or Tertiary strata.

Subfamily Trochocyathaceæ.

(Pali in several crowns.)

Genus Paracyathus, Milne-Edwards & Jules Haime (1848).

Paracyathus agassizi, Duncan. (Plate XLIII. figs. 5–8).

The corallum is tall, straight, and has a large incrusting base, and a narrow cylindrical stem spreading out into a subturbinate termination.

The calice is oval in outline, and not very deep, but widely open.

The columella occupies much space, and is made up of small processes.

The pali before the smaller septa are bilobed. The pali generally are not crowded, and are at different distances from the centre.

The septa are unequal, moderately close, largely granular laterally; and most of them terminate internally in an enlargement.

There are four complete cycles, and part of a fifth in some systems.

The costæ are distinct to the base, and are prominent in the upper third of the corallum; they are granular and subequal; but those of the larger septa are the most prominent above.

Height of corallum $\frac{5}{10}$ inch; length of calice $\frac{3}{10}$ inch.

Dredged up in No. 19 station, in the second expedition of the 'Porcupine,' from a depth of 248 fathoms.

I have named this beautiful species after Professor Alexander Agassiz, to whom I am much indebted for assistance in comparing the specimens dredged up in the first 'Porcupine' expedition with those of the American dredgings.

Paracyathus agassizi belongs to the group characterized by *Paracyathus crassus*, Ed. & H., of the London clay, and has greater affinities with that form than with any recent one.

Paracyathus striatus, Philippi, sp. (Plate XLIII. figs. 9–13.)

An ill-developed corallum, springing by false calicular gemmation from a parent, was dredged off the Mediterranean coast of Africa. It probably belongs to this species, although the costæ are rather more developed than they are described to be by MM. Milne-Edwards and Jules Haime.

A worn specimen, much covered with serpulæ, was dredged up in 60 to 160 fathoms, seven miles off Rinaldo's Chair.

A tolerably perfect specimen was dredged off the Adventure bank, of which the following are the specific characters:—

The corallum is turbinate and straight.

The wall is granular.

The costæ are alternately slightly unequal.

The columella is deep and not very large.
There are four cycles of unequal septa in six systems.
The pali of the third order are higher than the others.
The calice is elliptical.
Height of corallum $\frac{3}{10}$ inch; length of calice $\frac{2}{10}$ inch.

The American deep-sea *Paracyathi* are *Paracyathus confertus*, Pourtales, rare, in 50 to 100 fathoms off the Florida reef; and
Paracyathus de filippi, Duch. et Mich., of the Antilles.

Division Turbinoliaceæ.

Genus Sphenotrochus, Milne-Edwards & Jules Haime, *op. cit.* 1848.

Sphenotrochus intermedius, Münster, sp. (Plate XLI. figs. 1–5.)

MM. Milne-Edwards and Jules Haime distinguish between *Sphenotrochus intermedius*, Münster, sp., and *Sphenotrochus milletanus*, Defrance, sp., by writing "cette espèce (*Sphenotrochus milletanus*) est extrêmement voisine du *Sphenotrochus intermedius*: elle nous paraît n'en différer qu'en ce qu'elle est un peu plus élevée proportionnellement à la largeur, et presque aussi épaisse à la base qu'au calice; de plus les côtes sont moins saillantes latéralement, et sont plus souvent interrompues" (Hist. Nat. des Corall. vol. ii. p. 69). I do not think this establishes a specific distinction; and it appears to me that the form from the British Crag, which was described by Mr. Searles Wood as *Turbinolia milletiana*, and which was decided to be *Sphenotrochus intermedius* by MM. Milne-Edwards and Jules Haime, is really a variety of the French Falunian form.

Many specimens resembling the Crag forms have been dredged up in Tangier Bay in 35 fathoms, and off Cape Sagres in 45 to 50 fathoms.

Genus Sabinotrochus, Duncan.

The corallum is simple, flatly turbinate, and adherent by a delicate peduncle. The calice is flat. The septa are exsert; the costæ are delicate and numerous; and the columella consists of growths from the septal terminations.

Sabinotrochus apertus, Duncan. (Plate XLI. figs. 6–9.)

The corallum is button-shaped.
The wall is nearly horizontal, and forms a flat inverted cone, which is marked with unequal costæ.
The calicular margin is open and circular, being festooned, however, by the projecting primary and secondary septa.
The fossa is shallow; and the calice, as a whole, is slightly concave.
There are four cycles of septa in six systems; but occasionally some members of the

fourth, which are usually rudimentary, are absent. The primary and the secondary septa are nearly equal in size, and are large, projecting, exsert, thin, and marked with distinct granules. The secondary septa are not so high as the primary. The tertiary septa are smaller and less exsert than those already mentioned, and they usually unite to the secondary near the false columella.

The columella is formed by processes from the ends of the larger septa.

The interseptal spaces are broad and shallow.

The costæ are more numerous than the septa. The primary and secondary costæ are slightly prominent at the calicular margin, and may be traced to the fine peduncle. The third and fourth orders are less so; and there are some traces of a fifth cycle in the form of wavy rows of granules or ridges.

The height of the corallum is $\frac{3}{20}$ inch; and the breadth of the calice is $\frac{4}{10}$ inch.

Dredged up in No. 16 dredging, second expedition of the 'Porcupine,' and in 994 fathoms.

I have named this new Turbinolian genus after Sir Edward Sabine, K.C.B., the President of the Royal Society.

Genus Desmophyllum, Ehrenberg.

Desmophyllum crista-galli, Milne-Edwards and Jules Haime, 1848, *op. cit.* (Plate XLI. figs. 10–16.)

Desmophyllum dianthus, Ehrenb. 1834.

α. —— *cumingi*, Milne-Edwards & Jules Haime, 1848, *op. cit.*

β. —— *costatum*, Milne-Edwards & Jules Haime, 1848, *op. cit.*

If the variations of the typical form of this species are studied, it will be noticed that there are great differences in the position, size, and continuance of the costæ, in the exsertness and granulation of the septa, in the height, compressedness, and size of the base of the corallum, and in the granular ornamentation of the outside of the wall in different specimens. The recognition as varieties of the forms marked α and β, instead of species, is necessary.

The size, costal development, exsertness, and granular condition of the ornamentation of the septa and outside of the corallum depend upon the age and nutrition of the specimen. Very thin septa are not so granular superiorly as those of corallites which have very dense walls and thick septa; and the costæ of the latter kind are usually most prominent.

At great depths, 994 fathoms, No. 16 dredging; and where the Madreporaria appear to be very abundant the specimens of *Desmophyllum* are usually very granular externally; moreover they become attached to compound forms of corals, and both have the same ornamentation, so that it is difficult not to believe in the *Desmophyllum* being part and parcel of the growing mass. They are especially liable to be joined to branches of the fistulose bifurcating coral which will be described further on (*Solenosmilia variabilis*).

One specimen is attached partly to a broken specimen of a dwarfed variety with a small calice and without any costæ (No. 16 dredging).

A finely pedunculate form, with a wide base of attachment, is fixed on to the wall of a portion of a gigantic *Desmophyllum*. Both have exsert septa, and they project eccentrically also. The costæ of the perfect specimen are well developed; but the septa are thin, and the granular ornamentation is slight. The specimen came from a much shallower part of the sea than those of No. 16 dredging.

No. 6 dredging (second expedition), 358 fathoms, yielded two small specimens, parasitic upon a mass of *Amphihelia oculata*, Linnæus. The smallest, not more than $\frac{1}{10}$ inch in height, has six large primary septa, six rudimentary secondary septa, and traces of the tertiaries. A larger specimen, about $\frac{4}{10}$ inch high, has four perfect cycles, and resembles the full-grown *Desmophyllum stokesi* of Torquay, which is probably an immature form. The septa are feebly exsert.

No. 17 dredging, 1095 fathoms, second expedition, presented two specimens of varieties of *Desmophyllum*, which were more or less covered with serpulæ; they were granular externally.

The variety *costatum* is found in the Older Pliocene formations of Messina and Asti.

Genus Flabellum, Lesson, 1831.

Flabellum distinctum, Milne-Edwards & Jules Haime, 1848, *op. cit.* (Plate XXXIX. figs. 1–13.)

Flabellum extensum, Michelin.

Specimens of many different sizes and varieties of *Flabellum distinctum* were dredged up in No. 16 dredging (994 fathoms), No. 26 dredging (364 fathoms), and No. 28 dredging (304 fathoms) of the second expedition of the 'Porcupine.'

All have the peculiar and specific septal arrangement of the type described by MM. Milne-Edwards and Jules Haime; but there is great variation in the markings of the epitheca, the size of the lateral crests, the development of the other costæ, the size of the peduncle, and in the increase and diminution of the lateral angles. It is quite evident that *Flabellum extensum* must be absorbed; and it would have precedence were it a better species.

Flabellum distinctum is a Japanese form; and I have specimens of it in a fossil condition from the Tejares of Malaga, which are Miocene strata. *Flabellum extensum* has been found in the Turin Miocene, and in either Miocene or Pliocene strata at Villeneuve-lez-Avignon, and in deposits of unknown tertiary age at Antwerp.

Flabellum laciniatum, Ed. & H. (Plate XXXIX. figs. 14–18.)

Syn. *Phyllodes laciniatum*, A. Philippi.

Ulocyathus arcticus, Sars.

This *Flabellum* has a remarkably delicate wall, and a few well-developed thin septa alternating with others which are much smaller. The soft parts are excessively thick,

and they break the hard parts by their post-mortem contraction. I have only one small young perfect specimen out of many scores of large individuals. Consequently the species must be considered provisional.

It is a common form in the Norwegian and North Atlantic Seas, and has not yet been found in the Mediterranean or south of the British Channel. It is evidently the link between the genus *Flabellum* and *Desmophyllum*.

The species is found in the older Pliocene of Rometta.

Genus Rhizotrochus, Ed. & H. 1848.

Rhizotrochus affinis, Duncan. (Plate XLVII. figs. 17–19.)

The corallum is covered with a stout, well-developed epitheca. The radicles are well developed. The wall is very thin. The costæ barely exist. The septa are slightly exsert, unequal, wavy, and granular. There are four cycles of them, and part of the fifth also. Calice most elliptical in old specimens, circular in the young. Height of corallum $\frac{8}{10}$ inch. Locality: Mediterranean. No. 50*a*, 152 fathoms.

The reasons for associating the next genus (*Amphihelia*) with the *Turbinoliaceæ* in a new group ("those increasing by gemmation") are given at the end of the description of the species. The position of the genus amongst the *Oculinidæ* can no longer be maintained.

Division Gemmantes.

Genus Amphihelia, Milne-Edwards & Jules Haime[1].

The genus is differentiated as follows by its founders:—"Le polypier est dendroïde et résulte d'une gemmation alterne et distique. Le cœnenchyma prend beaucoup de développement dans les branches basilaires. Les polypiérites sont à peine costales au bord des calices. La columella est rudimentaire ou nulle. Il n'existe jamais de palis. Les cloisons sont peu nombreuses, entières, et débordent faiblement la muraille."

The typical form is the "white coral" *Madrepora oculata* of Linnæus; and M. Milne-Edwards states that it has a rudimentary columella, the surface of the wall striated here and there, and that there are three cycles of septa, the primary being slightly exsert and projecting outwards.

Their second species, *Amphihelia venusta*, has no columella, and three cycles of septa. There are short costal ridges near the calices, which are deep. The branches tend to develop on the same ventral plane.

M. Seguenza has described some fossil species from the Sicilian Tertiaries.

Amphihelia miocœnica, Seg. It has a distinct columella; and the wall is deeply striated and closely granular.

Amphihelia sculpta, Seg. It has no columella, but has cristiform costæ; and the striæ are flexuous, anastomosing, and closely granular.

[1] Hist. Nat. des Corall. vol. ii. p. 119.

I described shortly, in the report on the 'Porcupine'-Expedition Madreporaria[1], two species, *Amphihelia atlantica* and *Amphihelia ornata*. Both of these forms have columellæ; and one is striated on its wall, and the other is not.

In examining a specimen of *Diplohelia profunda*, Pourtales, dredged up by Pourtales in deep water off Bahia Honda (324 fathoms), I was much surprised, not only at its resemblance to some of the results of the No. 54 dredging, first expedition of 'Porcupine,' but also to the Amphihelians with striated walls.

Lately M. Sars has sent me a specimen of the *Madrepora ramea* of Müller, from off the Norwegian coast, found in moderately deep water. It is an *Amphihelia* like Seguenza's *A. miocœnica* and my *A. ornata*; and as it has an older date of publication, it must have precedence, and these and others be absorbed under the title of *Amphihelia ramea*, Müller, sp.

Now there is no distinction between *Diplohelia profunda*, Pourtales, and *Amphihelia ramea*, Müller, sp., and the first-named species must be absorbed.

What are the distinctions between *Amphihelia* and *Diplohelia*? *Diplohelia*, Milne-Edwards & Jules Haime, *op. cit.* vol. ii. p. 120, is differentiated as follows:—"Le polypier est dendroïde et présente dans les parties inférieures un cœnenchyma bien développé. Les calices affectent sur les rameaux une disposition alterne distique. La columella est spongieuse et bien développée. Il n'existe pas de palis. Les cloisons sont purement dentelées et débordent à peine la muraille."

Some of the species have granular walls, and others striated walls; and it will be readily observed that it is impossible to distinguish between Seguenza's and Müller's species of *Amphihelia* and the *Diploheliæ*, except on the plea that the species of the last-named genus have the septa finely toothed.

A careful examination of many specimens of *Amphiheliæ* has proved to me that the tertiary septa are often toothed in some corallites, and not in others of the same branch. The presence of a columella in the very numerous specimens of *Amphihelia oculata* and of *A. ramea* (which now includes the species already noticed) proves that the presence of one in *Diplohelia* is no differentiation. The absorption of *Diplohelia* by *Amphihelia* I consider necessary under our existing knowledge.

Diplohelia[2] *meneghiniana*, Seguenza, *D. doderleiniana*, Seguenza, *D. gismondiana*, Seguenza, *D. profunda*, Pourtales, are varieties of *Madrepora ramea*, Müller, or different parts of the same corallum possessing gemmative variation, as they all do.

All these striated *Diploheliæ* become classified under the species *Amphihelia ramea*, Müller, sp. (syn. *Madrepora ramea*).

The diagnosis of the genus *Amphihelia* by MM. Milne-Edwards and Jules Haime is not quite consistent with observations which those excellent authors could now make upon numerous and well-preserved specimens. Nor is my assertion, made in the Report

[1] Proc. Royal Society, March 24, 1870.

[2] Seguenza, *op. cit.* pp. 488, 489.

on the Corals of the First 'Porcupine'[1] Expedition, respecting the very close alliance of *Amphihelia* and *Lophohelia* consistent with facts I have observed since. I find that there are never any dissepimental structures developed in *Amphihelia*, whilst they exist and even take up the tabulate form in many specimens of *Lophohelia*.

The absence of the columella, in all the specimens of *Amphihelia* I have seen, is very rare indeed; and as the structure is never observed to be wanting in many consecutive corallites on a stem (for even at the worst the large septa join centrally), the want of the organ may be an arrest of development.

Every now and then the third cycle of septa is so very rudimentary in *Amphihelia oculata*, Linn., that doubts may be expressed about its existence; yet in the same corallum it may be visible in remote calices.

The existence in *Amphihelia* of well-developed spongy and trabecular columellæ, of very small columellæ of the same consistence, and of those formed by a swollen state of the inner and adherent margins of the larger septa is beyond doubt.

The ornamentation of the costæ and their general development afford specific distinctions.

By grouping the specimens obtained from the first and second expeditions of the 'Porcupine,' the following series may be distinguished:—

1. Columella moderately developed.
   Septa in two cycles, first and second equal, the third cycle either very rudimentary or wanting.
   Surface of wall plain. Costæ very fine, and serpentine near the newest calices.
2. Columella very small.
   Septa in three cycles, first and second unequal. Septa dentate.
   Surface plain.
3. as no. 2. Surface minutely and sharply granular.
4. as nos. 2 & 3. Costæ fine and visible near the calices.
5. Columella moderately developed.
   Septa in three cycles.
   Surface marked by continuous costal striæ.
6. Columella very small.
   Septa in three cycles, tertiary dentate.
   Surface marked by continuous and noncontinuous costal striæ, and covered with granules.
7. as no 6.
   Surface strongly striated. Septa not dentate.
8. Columella small.
   Septa in three cycles: the primaries are often exsert.
   Surface of wall plain. Costal striæ near new calices.

[1] Proc. Royal Society, 1870, P. M. Duncan.

9. as no. 8. The primary and secondary septa are exsert.
Surface of the wall sharply and finely granular. Costal striæ near new calices.
10. as no. 8. All the septa are exsert, and the costal striæ are strong.
11. as no. 10. The costæ are cristiform near the calices.
12. Columella well developed.
The septa are in three cycles; and sometimes one of a higher order is present.
Striæ long and granular, often not continuous.
Granules long.
13. Surface like shagreen, otherwise as no. 12.

It may be gleaned from this table that there are four groups:—1, with a plain wall-surface; 2, with a striated wall-surface; 3, with exsert septa; 4, with exsert septa and long striations and sharp granules.

Consequently the following diagnosis will include all the forms of *Amphihelia*.

Genus Amphihelia.

Syn. *Diplohelia*.

The corallum is bush-shaped; and the gemmation is alternate, marginal, and often double. The wall increases in thickness at the lower part of the corallum, and often includes the formerly free corallites. The corallites often coalesce. The columella exists. The septa are in six systems. There are not many cycles of them. The ornamentation of the wall may be none, or the costal striæ may exist.

The corallites do not fill up from below. There is no dissepimental tissue.

Amphihelia oculata, Linnæus, sp. (Plate XLV. figs. 1–3.)

Branches irregular and coalescent. Calices distant and circular in outline, very prominent on the younger branches, and immersed in the wall-tissue lower down in the corallum. Columella moderately developed. Septa in six systems; and either three cycles are developed, or only two, the third being rudimentary. Septa unequal in the first case, and equal in the second. Wall-surface plain, and striated near the new calices.

Variety α, with some septa slightly dentate.
Variety β, with the surface of the wall granular.
Variety γ, with exsert septa.

Amphihelia ramea, Müller, sp. (Plate XLV. figs. 4–6, Plate XLVI. figs. 1–19, and Plate XLIV. figs. 1–3.)

Syn. *Amphihelia miocænica*, Seguenza,
—— *atlantica*, nobis.
—— *ornata*, nobis.
Diplohelia profunda, Pourtales.

Syn. *Diplohelia meneghiniana*, Seguenza.
—— *doderleiniana*, Seguenza.
—— *sismondiana*, Seguenza; and all other *Diploheliæ* with costal striæ.

Branches irregular, and often coalescent.
Columella moderately well developed.
Septa in three cycles in six systems.
Costal striations distinct, long, sinuous, general and often granular.

Variety α. Septa, especially of third cycle, dentate.
Variety β. Surface of wall very aciculate, with granules on the costæ.
Variety γ. Costal striæ interrupted, and also continuous and curved.
Variety δ. With exsert septa.

The question now arises, in which family must the *Amphiheliæ* be placed?

Are they Oculinidæ? Have they dissepiments? Are there any proofs forthcoming that the corallites fill up within?

It is very evident that the walls of the bud thicken immensely; but I cannot detect in any instance any diminution of the original calibre of the visceral cavity by a deposit of any kind. Yet this is a necessary characteristic of the Oculinidæ.

The ragged condition of the septal edges is evidently an occasional peculiarity in the *Amphiheliæ*.

The *Amphiheliæ*, having no infilling of the visceral chamber, no dissepiments and no pali, and having solid walls and septa, which are usually not dentate, must be allied with such simple forms as *Ceratotrochus*, *Conotrochus*, and *Desmophyllum* amongst the Turbinoliidæ.

From the presence of a columella, the *Amphiheliæ* may be regarded as *Ceratotrochi* and *Conotrochi* which increase by marginal gemmation.

The next species to be described is very remarkable, not only for the great depth at which it lives, but also for the size and blue tint of some of the specimens.

Family **Astræidæ.**

Division Euphylliaceæ, Milne-Edwards & Jules Haime, Hist. Nat. des Corall. vol. ii. p. 183.

Section Euphylliaceæ cæspitosæ.

Genus Solenosmilia.

Genus nov. The corallum is bush-shaped; and the corallites, which rarely unite, are cylindrical and bifurcate. The terminal calices are produced by a bi-gemmation; and their fossæ and columellæ are in common. The tissue between the new calices is usually

costulate, and that over the rest of the corallum granular and without any epitheca. The calices increase by fissiparity, and form occasionally short series. Septa numerous, and not very exsert. Dissepiments common.

Solenosmilia variabilis, Duncan. (Plate XLII. figs. 11–18.)

The primary corallites are not much larger than the others. Wall usually granular, but shining to the naked eye, and rarely costulate throughout. Terminal calices bifurcate, and usually separated by costulate tissue. Fossa very deep. The columella is formed of laminæ and the paliform ends of the septa, and is very deeply situated. Septa barely exsert, granular laterally, unequal, long, and curved.

Most of the septa terminate at the columella in paliform prolongations. The septal number is very variable. There may be three complete cycles in six systems, four cycles in two systems, and three in the others; fifty-eight septa may be placed irregularly, so that the septal number varies from that characteristic of three cycles to four cycles, with members of the fifth.

The shape of the calices is very variable.

The dissepiments occur in some corallites, and not in others.

The costæ usually terminate high up.

Height of corallum 3 to 4 inches; length of corallites $\frac{4}{10}$ to $\frac{6}{10}$ inch; length of calices $\frac{3}{10}$ to $\frac{5}{10}$ inch; breadth of calices $\frac{1}{10}$ to $\frac{2}{10}$ inch.

Variation.—The amount of bud-variation is extraordinary; and some of the calices are exceedingly like stunted specimens of *Desmophyllum*. The bud of one specimen was decidedly costulate throughout.

The corallum is fragile-looking but is strong; for the wall is thick. Often there is a faint bluish tinge in the calices and central hard parts.

In dredging 17, 1095 fathoms, abundant; in dredging 32, 651 fathoms, one specimen, which was lighter than those of No. 17, and tinged blue. (2nd expedition.)

Section Stylinaceæ independentes.

Genus Lophohelia.

Lophohelia prolifera, Pallas, sp., 1766. (Plate XLIV. figs. 7–11.)

MM. Milne-Edwards and Jules Haime[1] distinguish the genus and species as follows:—

The corallum is dendroid, and its form results from an irregular alternate and subterminal (submarginal) gemmation.

The calices have their margins everted oftentimes and lamellar; and their central cavity is very deep. The septa are entire, exsert, and meet internally at the bottom of the visceral chamber by their inner margins, and without the existence of a columella and pali. No true cœnenchyma exists.

[1] Hist. Nat. des Corall. vol. ii. p. 116.

In a note, the thick walls of the corallites are referred to, as well as the existence of "traverses." The genus is admitted into the family of the Oculinidæ by MM. Milne-Edwards and Jules Haime; and they state, p. 102:—"The visceral chambers [of the Oculinidæ] only exhibit a small number of 'traverses,' or of incomplete 'planchers;' but they [the visceral chambers] tend to become narrow and contracted inferiorly, and even to fill up from below upwards by the growth of the wall, and sometimes of the columella also." Subsequently (same page) the authors state that the wall has neither "traverses" in its interior, nor epitheca on its surface.

Now it is most important to distinguish between the words "traverses" and "planchers," even when the latter are said to be incomplete.

"Traverses endothécales" correspond to the English term of endothecal dissepiments; and they extend between the septa, closing up the interseptal loculi; but they do not extend across the axial space in one uninterrupted tissue, so as to shut off the part below the calice above.

"Planchers," or "tabulæ," or "diaphragmes lamellaires," close the corallites at different heights, and form horizontal divisions, which extend from one wall to the other of the general visceral cavity, instead of occupying the breadth of the interseptal loculi above. The following words, however, complicate the matter somewhat:—"they [the planchers] differ from the 'traverses,' because "ils ne dépendent pas des cloisons," although the reference to the dissepiments which only close the interseptal loculi between the septa follows.

Tabulæ or "planchers" are independent of the septa, but they are formed by endothecal growth after the septal laminæ have been perfected in the visceral chamber. Then this is crossed by a development of hard structures within the membranes, and all below is shut off. The tabulæ extend across the axial space and between the septa, and in the interseptal loculi. An incomplete tabula is an anomaly, but may exist as the result of antecedent or of imperfect development.

The specimens of this genus are very numerous in the collection of dredgings; and I have had the opportunity of examining others from the American expedition, which were dredged off the Florida coast. M. Sars has sent me a Norwegian specimen; and Mr. Kent has shown me the beautiful series obtained by him south of Cape Finisterre, in 600 fathoms. The drawings of the fossil species described by M. Seguenza have been studied; and I have availed myself of a number of recent specimens obtained from unknown localities.

The result of my study of a great series of forms which must be included in the genus, is to prove that the corallites do not fill up inferiorly, but that the wall increases externally, that small dissepiments often exist, that perfect tabulæ are by no means uncommon, and that some specimens have no endotheca whatever.

The variability of the species is immense; and the corallites on the same stem are also variable.

The septa are not incised on their free margins, and are remarkable, so far as their number is concerned, for their very irregular cyclical arrangement. Some primary septa are very large, exsert, and project outwards; others of the same cycle are not much larger than the secondaries, and barely project at all.

The costæ may be but faint striations, or distinct crests on corallites of the same stem; and occasionally not a trace of any other markings than the granulation of the wall may be observed.

The position of the gemmation varies greatly, and may be on the calicular margin, a little way down or some distance down the wall on the same corallum; and the rest of the corallite varies as much as the other details.

I cannot understand why *Lophohelia* should be classified with the Oculinidæ, whose essential peculiarities are given by MM. Milne-Edwards and Jules Haime, Hist. Nat. des Corall. vol. ii. p. 102.

In estimating the value of their differentiation, it must be remembered that lateral gemmation is common to other families, that thick imperforate walls are so also, and that the thickness of the wall in the Oculinidæ is not produced by what is termed cœnenchyma in the aggregate Astræidæ.

The paucity of the peculiar endotheca is not characteristic. But the filling-up of the visceral cavity is rather peculiar, and in a general sense may be sufficiently correlated with the other characteristics to form a structure common to the family.

A careful examination has not proved that this filling up occurs in *Lophohelia*.

Lophohelia, as a genus, possesses entire septa; and as it has endotheca, and no true cœnenchyma, it must be associated with the Eusmiliinæ, amongst the Astræidæ.

The groups of the Trochosmiliaceæ and Euphylliaceæ will not admit the genus; but it is evidently closely allied to the genus *Dendrosmilia* of the Stylinaceæ (indépendantes, Ed. & H.), *op. cit.* p. 220.

I therefore propose to remove the genus *Lophohelia* from the Oculinidæ, and to re-write its generic diagnosis.

Family **Astræidæ.**

Subfamily Eusmiliinæ.

Division Stylinaceæ.

Section Stylinaceæ independentes.

Genus Lophohelia.

The corallum is dendroid, and its gemmation is subterminal and irregularly alternate. The wall is very thick. The calices are very deep. The septa are irregular in their cyclical arrangement. There is no columella. There are dissepiments, and strong well-developed tabulæ.

LOPHOHELIA PROLIFERA, Pallas, sp.

The corallum is tall, and either dendroid or boat-shaped; and the corallites often unite laterally.

The corallites are long, turbinate, subturbinate, cylindrical, claviform, and cyathiform, or short. They are often deformed.

The wall is finely granular.

The costæ may exist as crests here and there, as very fine curved lines, or they may be absent.

The wall is thick, especially inferiorly.

The calicular margin may be circular, elliptical, or deformed in outline; it may be open, inverted, everted, or not.

The calicular fossa may be very deep, or may be crossed by tabulæ at different depths.

The septa are never in three, four, or five perfect cycles in six systems. The number of the larger septa varies, as does the amount of the exsertness, projection outwards, and breadth.

The septal laminæ are unequal, larger and thicker at the margin than elsewhere, and they approach each other at the bottom of the fossa.

The septal ends are usually not in contact; but occasionally some trabeculæ join them low down.

The tabulæ are thick and variable in their position.

The dissepiments are small, and rarely extend beyond the interseptal loculi.

The height of the corallum and the size of the corallites vary greatly.

The variability of the group of forms included in this species is extreme. On one stem corallites which answer to *Lophohelia prolifera*, Pallas, sp., *L. anthophyllites*, Ellis & Solander, sp., *L. subcostata*, Ed. & H., *L. affinis*, Pourtales, *L. defrancei*, Defrance [1], and *L. stoppiniana*, Seg.[1], can be observed; and other stems, or rather independent corals, consist of corallites possessing the special attributes of one of the species only.

The coalescence of the corallites varies in amount, as does the thickness and weight of the corallum.

In some large corallites, with calices measuring $\frac{1}{2}$ inch in breadth, there are four cycles and some septa of the fifth; but usually in calices of less size the fourth cycle is incomplete.

Two specimens were dredged up in the Mediterranean (No. 58, depth 266 fathoms), between Sicily and the African coast; and thus the coral must be received as one of the fauna of the Mediterranean, although previously doubt had been cast upon it.

Its usual habitat is in the North Sea, the North Atlantic, and off the French and Spanish coasts; and it frequents rocky ground.

[1] Fossil species.

LOPHOHELIA PROLIFERA, Pallas, sp. (Plate XLII. figs. 1, 2.)

Variety *gracilis*.

SYN. *Lophohelia gracilis*, Seguenza.

The fossil coral *Lophohelia gracilis* described by Seguenza[1], and associated by him with two varieties (*α striata* and *β latistella*), is represented by numerous living forms in deep sea (554 fathoms) to the west of the promontory of Tangier (No. 33).

The specimens I have had the advantage of examining from the dredgings are so numerous that I have been able to study their range of variation. It is evident that the delicate form *gracilis* is connected by intermediate ones with the dwarfed and then with the large *Lophohelia prolifera*. The pretty little type must then be considered a race or subspecies; and doubtless, when dredging operations are finished to the south of the Straits of Gibraltar, it will be found to replace the great *Lophohelia* of the north.

The variation of the corallites on the same corallum is very great.

Family **Oculinidæ**.

Subfamily STYLASTRACEÆ.

Genus STYLASTER.

STYLASTER GEMMASCENS, Esper, sp. (Plate XLIX. figs. 1–6, 8–10, 13–15.)

"The corallum is subflabelliform. The branches often coalesce; and the younger are crowded with small granulations, which are irregularly placed between the calices. The old branches are almost smooth. The calices are alternate on young branches, and sparingly developed on the old; they are circular, oval, or deformed, and have projecting margins. There are from twelve to sixteen septa, which are often irregular."

This is the diagnosis which is given by Milne-Edwards and Jules Haime[2]; and it accords closely with that characteristic of several specimens which were dredged up in the first expedition of the 'Porcupine,' and also in the previous expedition of the 'Lightning.' The specimens from the 'Porcupine' collection came from No. 54 dredging, at a depth of 530 fathoms. I considered the specimens to belong to the genus *Allopora*; but a reexamination of them, in which I have been greatly assisted by Mr. Kent, of the British Museum, determines me to associate them with the species just described. The type of the species came from the Indian Ocean; and the North-Atlantic forms are as well developed as those somewhat roughly drawn by Esper.

[1] Seguenza, Mem. della Reale Accad. di Torino, t. xxii. serie 2, p. 493.

[2] *Op. cit.* vol. ii. p. 131.

Section PERFORATA.

Family **Madreporaria.**

Subfamily EUPSAMMIINÆ.

Genus BALANOPHYLLIA, Searles Wood, Ann. Mag. Nat. Hist. 1844.

BALANOPHYLLIA GADITANA, Duncan.

The corallum is claviform and cylindrical, and has a rounded base, with a scar of former adhesion. The epitheca exists here and there.

The costæ are subequal and flat.

The calice is circular in outline, and is very deep centrally.

The septa are unequal, thick, and irregular. The smallest join the others near the calicular margin; others unite midway to the columella to the internal edge of the large septa.

There are four incomplete cycles of septa in six systems.

The columella is very small, and is situated deeply.

Height of corallum $\frac{6}{10}$ inch; breadth of calice $\frac{2}{10}$ inch.

Dredged in No. 29 station, and in 227 fathoms. The specimen was dead, and had been so for some time.

BALANOPHYLLIA CELLULOSA, Duncan. (Plate XLIX. figs. 11, 12.)

The corallum is subturbinate and curved. There is a very small scar of former attachment. The epitheca is well developed, and extends up to the calicular margin, and it gives the sharply granular character to the subequal costæ.

Costæ very distinct at the base and elsewhere.

The calice is circular in outline and not deep. The columella is cellular and small, and does not project.

The septa are few in number. The primary septa are large, thick, exsert, and consist of cellular tissue. The other septa are represented by trabeculæ, so that the cyclical arrangement cannot be discovered.

Height of corallum $\frac{1}{2}$ inch; breadth of calice $\frac{2}{10}$ inch.

Dredged up, somewhat injured, from 292 fathoms, No. 24. The specimen figured was probably alive when dredged up.

The epitheca, which is strongly developed in some species of the genus, affords but secondary characters for differentiation; consequently the genus must include *Thecopsammia* of Pourtales.

BALANOPHYLLIA SOCIALIS, Pourtales, sp. (Plate XLIII. figs. 14–19.)

Thecopsammia socialis, Pourtales.

This species has been described by Pourtales, under the generic name of *Theco-*

psammia, in the 'Contributions to the Fauna of the Gulf-stream at great Depths' (2nd series), p. 138.

The very stout and thick wall, and the complete epitheca, reaching up far towards the calicular margin in some and not so far in other corallites, are very distinctive. Moreover the bending and meeting of the smaller and larger septa is only visible low down and by a section. In some of the North-Atlantic specimens the epitheca is perfect, and only marked by circular ridges; in others there are traces of longitudinal costæ in the form of rows of granules. Some varieties present these costal markings very distinctly.

The origin of one corallum from another is evident in the American specimens; but it is probably an accidental circumstance.

The following is the diagnosis of the species:—

Corallum turbinate, rather long, conical, with a peduncle. Wall thick, very porous and vermiculated. Epitheca well developed and rising to various heights, marked with transverse ridges, and either perfectly plain or ornamented by longitudinal costa-like markings. Calice elliptical. Fossa deep. The septa are entire, smooth, crowded, not exsert, thick near the wall. There are five incomplete cycles of septa in six systems. The septa of the fourth cycle bend toward each other and meet in front of the tertiary septa in the deeper part of the calice. The fifth cycle is incomplete.

The columella is papillose and porous and situated deeply.

Common in 100 to 300 fathoms off the Florida reef.

Variety *britannica*. Has the epitheca close up to the calicular margin, and it is quite plain.

Variety *jeffreysia*. Has the costulate ornamentation.

The specimens of the species and the varieties were obtained during the first expedition of the 'Porcupine,' in from 345 fathoms to 363 fathoms, and in a temperature from 29°·9 F. to 31°·8 F.

Genus Dendrophyllia, Blainville.

Dendrophyllia cornigera, Lamarck, sp.

A very old and worn specimen was dredged up from a depth of 207 fathoms (No. 54, 2nd expedition), off the Mediterranean coast of Africa.

The coral is a well-known Mediterranean form, and is also an inhabitant of the Gulf of Gascony.

It is found fossil in the Older Pliocene of Tremonte, in Sicily.

Family **Fungiidæ**, Dana.

Fungia symmetrica, Pourtales. (Plate XLIX. figs. 16–19.)

A young specimen and some fragments of others were dredged up in 994 fathoms (No. 16 dredging, 2nd expedition). The description given by Count Pourtales in his

'Deep-sea Corals,' No. 4, Illustrated Catalogue, &c., 1871, of this coral, has enabled me to place it amongst the fauna of the eastern Atlantic.

Section RUGOSA.

Family **Cyathaxonidæ.**

Genus Guynia, Duncan.

The corallum is simple and long. The wall is thick and solid. The septa are well developed, lamellar, unequal, and are continuous from the base to the calice. There are four systems of septa; and one primary septum is longer and larger than the others. The columella is essential, and is attached to the larger septa.

There is no endotheca.

The costæ are visible on the growth-rings of the outside of the wall. There is an epitheca.

Guynia annulata, spec. nov. (Plate XLVII. figs. 9–16.)

The corallum is long, cylindrical, and narrow. It is sometimes curved. The accretion-ridges are well developed and regular, and are marked with prominent short spinicles, laminæ, or granules, which correspond with the costæ. The epitheca which ornaments the ridges is delicate. The costæ extend over the whole length of the corallum, and usually exist as flat bands between the close and rather wavy accretion-ridges. There are four principal septa, one of which is larger than the others, at the calice. The four secondary septa are often as large as the primary; but the eight tertiary septa are almost rudimentary. There are four systems of septa and three cycles in each. None are exsert. The columella is stout, cylindrical, deeply seated in the calice, and adheres to the larger septa. The interseptal loculi are large; and the transverse outline of the corallum is sometimes rather angular. The length of the perfect corallum probably $\frac{3}{4}$ inch, the breadth $\frac{1}{20}$ inch.

Locality: Adventure bank, in 92 fathoms. It is frequently found adherent by its side to shells and foreign bodies.

Longitudinal sections prove the absence of endotheca.

In three specimens there were evidences of an hexameral septal arrangement. One had the octomeral at the base, but the hexameral at the calicular end. A transverse section midway showed the eight large septa; so that there must have been an arrest of development during growth, and the specimen illustrates the formation of the neozoic type from the rugose. A second specimen, when scraped down, showed the union of a septum with another; and as this occurred in two instances, seen in one and inferred in another, the arrest of development was accounted for.

The interesting affinity of this form with the rugose coral *Haplophyllia paradoxa*,

Pourtales, dredged up in 324 fathoms off the Florida reef, is well worthy of study, and has formed part of a late memoir by me to the Royal Society[1].

The following species is remarkable, but I cannot place it in any satisfactory position:—

Genus incertæ sedis.

—— ——. (Plate XLVII. figs. 1–8.)

The corallum is simple and flat; the calice is very open, shallow, and irregular, and unsymmetrical in shape, and its margin is broad.

The costæ are large, and irregular in their course and arrangement; they are in some places straight and subequal, in others curved and unequal; but all are finely granular and rounded.

There is no epitheca, no dissepimental tissue; but there are synapticulæ.

The septa are irregular, rather exsert, in places are thin, alternately large and small, and granular; they pass towards different parts of the centre of the calice. The columella is rudimentary in one portion of the calicular axis, and exists along what appears to be an old line of fracture, which forms a ridge at the base also. There are no pali.

The specimens appear to have been injured during life and repaired. A smaller specimen, which appears to have been fractured, has grown at the fractured end and developed small septa.

It is impossible to place these specimens satisfactorily in any genus: they may belong to *Diaseris*; but the resemblance of their bases to those of *Hemicyathus crassicostatus*, Seguenza, Older Pliocene, is most remarkable. The absence of pali, however, prevents the inclusion of the forms in that genus.

Genus Pliobothrus, Pourtales.

Pliobothrus symmetricus, Pourtales. (Plate XLIX. fig. 7.)

A specimen of this form was dredged up in the cold area of the North Atlantic, in 500 to 600 fathoms.

I doubt much whether it is one of the Tabulata; but I introduce it here, and refer to Count Pourtales's description in his 'Deep-Sea Corals,' No. 4 (Illustr. Cat. Museum Harvard Coll. 1871, p. 57)—a most remarkable and interesting work, which, unfortunately for me, came to hand many months after the completion of this essay.

[1] Phil. Trans. Royal Society, 1872.

Distribution of the Species in the Recent and Past Faunas.

Name.	Recent.	Old Pliocene.	Miocene.	Cretaceous.
Caryophyllia clavus	Mediterranean, North Atlantic, and West Indies.	+	—	—
—— cyathus	Mediterranean and Straits	—	—	—
—— seguenzæ	North Atlantic	+	—	—
—— arcuata	Coast of Spain, 304 fms.	+	—	—
—— cylindracea	Coast of Spain, 740 fms.	—	—	+
—— abyssorum	Coast of Spain, 1095 fms.	—	—	a
—— inskipi	Bay of Biscay, 539 fms.	—	—	a
—— calveri	Coast of Spain	—	—	—
—— vermiformis	Coast of Spain	—	—	—
—— pourtalesi	Coast of Spain	—	—	—
Bathycyathus atlanticus	Coast of Spain, 1095 fms.	—	—	a
Paracyathus agassizi	Coast of Spain	—	—	—
—— striatus	Mediterranean coast of Africa	—	—	—
Sphenotrochus intermedius	Tangier Bay	+	—	—
Sabinotrochus apertus	Coast of Spain	—	—	—
Desmophyllum crista-galli	Coast of Spain	+	—	—
Flabellum distinctum	Coast of Spain, Japanese seas	—	+	—
—— laciniatum	North Atlantic	+	—	—
Rhizotrochus affinis	Algerian coast	—	—	—
Amphihelia oculata	Mediterranean and North Atlantic	—	—	—
—— ramea, and varieties	Mediterranean, North Atlantic, and Florida.	+	—	a
Lophohelia prolifera, and varieties	Mediterranean, North Atlantic, Florida, and Indian seas.	+	—	—
Stylaster gemmascens	North Atlantic	—	—	—
Balanophyllia gaditana	Coast of Spain	—	—	—
—— cellulosa	Coast of Spain	—	—	—
—— socialis	North Atlantic and Florida	—	—	—
Solenosmilia variabilis	Coast of Spain, 1095 fms.	—	—	—
Dendrophyllia cornigera	Mediterranean coast of Africa	+	—	—
Fungia symmetrica	Cuba and coast of Spain	—	—	—
Guynia annulata	Adventure Bank	—	—	—
	Recent, no. 30.	9	1	1, and 4 allied.

Résumé.

1. That the deep-sea corals differ from the reef-building forms in not possessing certain important cœnenchymal structures.

2. That deep-sea corals have been dredged up from a depth of 1094 fathoms.

3. That deep-sea corals live in very different temperatures, from 29°·9 to 56°·3 Fahrenheit.

4. That the growth of deep-sea corals is very vigorous at great depths and in low temperatures.

5. That the variability of deep-sea species is very great.

6. That genera and species exist at great depths which are unknown elsewhere.

7. That the horizontal distribution of many deep-sea forms is great.

8. That the present deep-sea coral faunas contain species and varieties of species of

the Pliocene, Miocene, and Cretaceous deep-sea faunas, and offshoots of the Palæozoic fauna.

9. That, omitting varieties, and counting species only, there are thirty species in the 'Porcupine' dredgings, and of these eleven are known as fossil forms also. Moreover four others are closely allied to fossil forms.

IV. Tables of Localities, &c.

First Expedition of the 'Porcupine.'

Station.	Latitude north.	Longitude west.	Depth. fathoms.	Temperature of bottom.
2	51° 57′	10° 23′	30–40	52°·0
3	51 51	11 50	370	....
5	52 4	12 8	364	48·8
6	00 00	00 00	000	00·0
13	53 42	13 55	208	49·6
14	53 49	13 15	173	49·6
15	54 5	12 7	422	47·0
25	56 41	13 39	164	46·5
54	59 56	6 27	363	31·5
65	61 10	2 21	345	29·9
88	59 26	8 23	705	42·65

Species Dredged up.

No. 2. Caryophyllia clavus, variety borealis.
3. Flabellum laciniatum.
5. Lophohelia prolifera and varieties.
6. Caryophyllia clavus, var. epithecata.
13. Lophohelia prolifera, and varieties.
14. Lophohelia prolifera, and varieties.
15. Lophohelia prolifera, and varieties.
25. Flabellum laciniatum, Lophohelia prolifera, and varieties.
54. Lophohelia prolifera and varieties, Amphihelia oculata and varieties, Amphihelia ramea and varieties, Balanophyllia socialis and varieties, Stylaster gemmascens.
65. Balanophyllia socialis, variety.
88. Caryophyllia clavus, and varieties.
Caryophyllia seguenzæ.

Pliobothrus symmetricus, Pourtales, I do not consider to be a Madreporarian.

Second Expedition.

6	48 26	9 44	358	50·3 F.
9	48 6	9 18	539	48·0
16	39 85	9 56	994	40·3
17	39 42	9 43	1095	39·7
17*a*	39 39	9 39	740	49·3

Station.	Latitude north.	Longitude west.	Depth. fathoms.	Temperature of bottom.
19	39° 27′	9° 39′	248	51°·7
24	37 19	9 13	292	52·7
26	36 44	8 8	364	52·7
27	36 37	7 33	322	51·3
28	36 29	7 16	304	53·3
29	36 20	6 47	227	55·0
32	35 41	7 8	651	50·0
33	35 33	6 54	554	49·7
36	35 35	6 26	128	55·0
45 M.	35 36	2 29	207	54·7
50 *a* M.	.... Algerine coast		150	54·7

Species.

No. 6. Amphihelia oculata, Amphihelia ramea, Desmophyllum crista-galli.
9. Caryophyllia cylindracea, var. *α*, Caryophyllia inskipi.
16. Desmophyllum crista-galli, Flabellum distinctum, Caryophyllia pourtalesi, Sabinotrochus apertus, Fungia symmetrica.
17. Desmophyllum crista-galli, Caryophyllia abyssorum, Solenosmilia variabilis, Bathycyathus atlanticus.
17 *a*. Bathycyathus atlanticus, Caryophyllia vermiformis, Caryophyllia cylindracea, var.
19. Paracyathus agassizi, Caryophyllia arcuata, var.
24. Caryophyllia pourtalesi, Caryophyllia arcuata, var., Amphihelia oculata, Lophohelia prolifera, var. gracilis, Balanophyllia cellulosa, Caryophyllia calveri.
26. Amphihelia oculata, Caryophyllia clavus, Flabellum distinctum.
27. Amphihelia oculata.
28. Caryophyllia clavus, Caryophyllia arcuata, var., Lophohelia prolifera, var. gracilis, Gen. incert. sedis, Flabellum distinctum.
29. Balanophyllia gaditana, Caryophyllia pourtalesi, Caryophyllia clavus, var. *γ*, and Caryophyllia clavus (type).
32. Caryophyllia cyathus, var., Lophohelia prolifera, var. gracilis, Amphihelia oculata, Solenosmilia variabilis.
33. Lophohelia prolifera, var. gracilis.
36. Lophohelia prolifera, var. gracilis, Amphihelia ramea, Caryophyllia clavus.
45. Dendrophyllia cornigera.
50 *a*. Rhizotrochus affinis.

57 M.[1]	36 6	13 10 E.	224	?
67 M.	Strait of Gibraltar		188	55·3
Adventure Bank			92 M.	
Coast of Tunis			40–100 M.	
Mediterranean coast of Africa				
Cape Sagras and Tangier Bay			35	
Seven miles from Rinaldo's Chair			60–160 M.	
Cartagena Bay				
Malta Telegraph Cable				

[1] M. Mediterranean dredgings.

Species.

No. 57. Lophohelia prolifera, Amphihelia oculata, Amphihelia ramea, Caryophyllia clavus, var. α, Caryophyllia clavus.

67. Amphihelia oculata, var.

A. B. Guynia annulata, Paracyathus striatus, Caryophyllia clavus, var.

C. T. Caryophyllia clavus.

M. c. of A. Paracyathus striatus, Caryophyllia clavus, var. borealis, Caryophyllia clavus, var. smithi, Caryophyllia clavus, var. elongata, Desmophyllia crista-galli.

Cape Sagras and Tangier Bay. Sphenotrochus intermedius.

Seven m. R. C. Caryophyllia clavus, var. borealis and var. β, Paracyathus striatus.

Carth. Bay. Caryophyllia clavus, var. β.

M. T. C. Caryophyllia clavus, var. smithi.

DESCRIPTION OF THE PLATES.

PLATE XXXIX.

Figs. 1–13. *Flabellum distinctum*, Ed. & H.

Fig. 1. Part of the calice, magnified.

Fig. 2. Front view of corallum.

Fig. 3. Side view.

Fig. 4. Calice.

Figs. 5, 6, 7, 8, 9, 10, 12, 13. Front and upper views of specimens, showing variation in form.

Fig. 11. Septa of *Flabellum laciniatum.*

Figs. 14, 15. Calicular end, nat. size and magnified, of *Flabellum laciniatum.*

Figs. 16–18. Front view, nat. size and magnified.

PLATE XL.

Figs. 1–4. *Caryophyllia abyssorum.*

Fig. 1.
Fig. 2. } Costæ, magnified.

Fig. 3. Corallum, nat. size.

Fig. 4. Calice, magnified.

Fig. 5. Costæ, magnified, of *Caryophyllia cylindracea.*

Fig. 6. Costæ, lower end of, „

Fig. 7. Corallum „

Fig. 8. Calice, magnified, „

Fig. 9. Costæ, magnified, of a variety of *Caryophyllia cylindracea.*

Fig. 10. Lower end „ „

Fig. 11. Corallum, nat. size, „ „

Fig. 12. Calice, magnified, „ „

Fig. 13. Corallum, nat. size, of *Caryophyllia vermiformis.*
Fig. 14. Corallum, magnified, ,,
Fig. 15. Costæ, magnified, ,,
Fig. 16. Calice, magnified, ,,

PLATE XLI.

Fig. 1. Corallum, nat. size, of *Sphenotrochus intermedius.*
Fig. 2. Corallum, magnified, ,,
Fig. 3. Corallum, magnified, variety ,,
Fig. 4. Corallum, nat. size, variety ,,
Fig. 5. Calice, magnified, ,,
Fig. 6. Upper view of corallum of *Sabinotrochus apertus.*
Fig. 7. Side view of corallum ,,
Fig. 8. Calice, magnified, ,,
Fig. 9. Base, magnified, ,,
Figs. 10–15. Views of *Desmophyllum crista-galli.*
Fig. 16. Section of the peduncle of a small specimen, magnified.

PLATE XLII.

Fig. 1. *Lophohelia prolifera*, var. *gracilis.*
Fig. 2. Calices, magnified.
Fig. 3. Costæ, magnified, of *Caryophyllia pourtalesi.*
Fig. 4. Corallum (young), nat. size, ,,
Fig. 5. Same, magnified, ,,
Fig. 6. Calice, magnified, ,,
Fig. 7. Very young calice, magnified, ,,
Fig. 8. Corallum, nat. size, ,,
Fig. 9. Costæ, magnified, ,,
Fig. 10. Calice, magnified, ,,
Fig. 11. Portion of corallum of *Solenosmilia variabilis.*
Fig. 12. Calice, magnified, ,,
Fig. 13. Costal ends, magnified, ,,
Fig. 14. Calice, magnified, ,,
Fig. 15. Corallum ,,
Fig. 16. Costæ, magnified, ,,

Fig. 17. Calice, magnified, of *Solenosmilia variabilis.*
Fig. 18. Corallum (old) ,,

PLATE XLIII.

Fig. 1. Corallum of *Caryophyllia arcuata*, variety.
Fig. 2. Calice, magnified.
Fig. 3. Costæ, magnified.
Fig. 4. Ornamentation of the septa, magnified.
Fig. 5. Corallum of *Paracyathus agassizi.*
Fig. 6. Its calice, magnified.
Fig. 7. The costæ, magnified.
Fig. 8. Septum and pali, magnified.
Fig. 9. Corallum of *Paracyathus striatus.*
Fig. 10. Its calice, magnified.
Fig. 11. The calicular termination, showing the tall pali.
Fig. 12. A septum, magnified.
Fig. 13. A corallum growing from the calice of a parent.
Figs. 14.–19. Corallites of *Balanophyllia socialis.*
Fig. 15. Calicular view.
Fig. 16. Calicular view, magnified.
Fig. 17. View of fractured peduncle.
Fig. 18. The costæ and epitheca, magnified.

PLATE XLIV.

Fig. 1. Corallum of variety of *Amphihelia ramea.*
Fig. 3. Another specimen, slightly magnified.
Fig. 2. A calice, magnified.
Fig. 4. Corallum of *Caryophillia seguenzæ.*
Fig. 5. Its costæ, magnified.
Fig. 6. The calice, magnified.
Figs. 7 & 8. Side views of unusual shapes of buds of *Lophohelia prolifera.*
Fig. 9. Magnified stem, showing the increase of wall-thickness outside the visceral cavity.
Fig. 10. Section of a corallite, showing tabulæ.
Fig. 11. Magnified view of a calice.

PLATE XLV.

Fig. 1. Corallum of *Amphihelia oculata.*
Fig. 2. Calicular ends, magnified.

Fig. 3. Calice, magnified.
Fig. 4. *Amphihelia ramea.*
Fig. 5. Ornamentation of the corallites, magnified.
Fig. 6. Calice magnified.

PLATE XLVI.

Fig. 1. }
Fig. 3. |
Fig. 6. |
Fig. 8. } Corallites of varieties of *Amphihelia ramea.*
Fig. 11. |
Fig. 14. |
Fig. 17. }

The other figures represent magnified views of branches, of ornamentation and calices.

PLATE XLVII.

Figs. 1 & 5. View of corallum of a species the genus of which is doubtful.
Fig. 2. Side view, magnified.
Fig. 3. Calicular surface, magnified.
Fig. 4. Base, magnified.
Figs. 6 & 7. Base and calice of another specimen, magnified.
Fig. 8. Costæ, magnified.
Fig. 9. }
Fig. 11. } Corallites of *Guynia annulata.* Figs. 11 & 13. On shells.
Fig. 13. }
Fig. 10. }
Fig. 12. } Side view, magnified.
Fig. 14. Corallum adherent by its side, magnified.
Fig. 15. }
Fig. 16. } Calice, magnified.
Fig. 17. Group of *Rhizotrochus affinis.*
Fig. 18. Corallum, slightly magnified.
Fig. 19. Calice, magnified.

PLATE XLVIII.

Fig. 1. Corallum of *Bathycyathus atlanticus.*
Fig. 2. Calice, magnified.
Fig. 3. Corallum of *Caryophyllia cyathus*, variety *α.*
Fig. 4. Calice, magnified.
Fig. 5. Corallum of *Caryophyllia clavus*, var. *exserta.*
Fig. 6. „ „ var. *borealis.*

Fig. 7. Corallum of *Caryophyllia clavus*, var. *elongata*.
Fig. 8. Calice magnified.
Fig. 9. Corallum of *Caryophyllia clavus*.
Fig. 10. Calice, magnified.
Fig. 11. Corallum of *Caryophyllia clavus*, var. *smithii*.
Fig. 12. Calice (worn), magnified.
Figs. 13, 14. Corallum of *Caryophyllia clavus*, var. *epithecata*.
Fig. 15. Corallum of an aberrant specimen of var. *epithecata*.
Fig. 16. Calice, showing a circular outline.

PLATE XLIX.

Figs. 1–6. Corallites and details of *Stylaster gemmascens*.
Figs. 8–10. „ „ „
Figs. 13–15. „ „ „
Fig. 7. *Pliobothrus symmetricus*.
Fig. 11. *Balanophyllia cellulosa*, corallum of.
Fig. 12. Corallum, greatly magnified.
Figs. 16, 17. Corallum of *Fungia symmetrica*.
Fig. 18. The calice magnified.
Fig. 19. Costæ with synapticulæ, magnified.